

**Rulemaking Framework for  
Refrigerated Bottled or Canned Beverage Vending Machines**

**United States Department of Energy  
Office of Energy Efficiency and Renewable Energy  
Building Technologies Program**

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## LIST OF ACRONYMS

|                 |  |
|-----------------|--|
| ABA             | American Beverage Association  |
| AEO             | Annual Energy Outlook  |
| ANOPR           | advance notice of proposed rulemaking                                      |
| ASHRAE          | American Society of Heating, Refrigerating, and Air-Conditioning Engineers |
| BT              | Building Technologies Program  |
| CFR             | Code of Federal Regulations  |
| CEC             | California Energy Commission   |
| CO <sub>2</sub> | carbon dioxide   |
| CSA             | Canadian Standards Association   |
| CSL             | candidate standard level   |
| DOE             | United States Department of Energy   |
| DOJ             | United States Department of Justice  |
| ECM             | electronically commutated motor  |
| EERE            | Office of Energy Efficiency and Renewable Energy                           |
| EIA             | Energy Information Administration  |
| E.O.            | Executive Order  |
| EPACT 1992      | Energy Policy Act of 1992  |
| EPACT 2005      | Energy Policy Act of 2005  |
| EPCA            | Energy Policy and Conservation Act   |
| FR              | Federal Register   |
| GRIM            | Government Regulatory Impact Model   |
| HCFC            | hydrochlorofluorocarbon  |
| HFC             | hydrofluorocarbon  |
| ImSET           | Impact of Sector Energy Technologies                                       |
| LCC             | life-cycle cost  |
| MIA             | manufacturer impact analysis   |
| NAMA            | National Automatic Merchandising Association                               |
| NECPA           | National Energy Conservation Policy Act of 1978                            |
| NEMS            | National Energy Modeling System  |
| NES             | national energy savings  |
| NOPR            | notice of proposed rulemaking  |
| NO <sub>x</sub> | oxides of nitrogen   |
| NPV             | net present value  |
| OIRA            | Office of Information and Regulatory Affairs                               |
| R&D             | research and development   |
| RIA             | regulatory impact analysis   |
| SG&A            | selling, general, and administrative costs                                 |
| SO <sub>2</sub> | sulfur dioxide   |
| TSD             | technical support document   |
| TSL             | trial standard level   |
| U.S.C.          | United States Code   |
| UL              | Underwriters Laboratories  |
| WACC            | weighted-average cost of capital   |

# Rulemaking Framework for Beverage Vending Machines

## 1 INTRODUCTION

The purpose of this document is to describe the procedural and analytical approaches the U.S. Department of Energy (the Department or DOE) anticipates using to evaluate and establish energy conservation standards for refrigerated bottled or canned beverage vending machines (herein referred to as beverage vending machines). These energy conservation standards apply to beverage vending machines manufactured on or after August 8, 2012, as mandated by section 135(c)(4) of the Energy Policy Act of 2005 (EPACT 2005).

The DOE Appliances and Commercial Equipment Standards Program, of the Office of Energy Efficiency and Renewable Energy's (EERE's) Building Technologies Program (BT), develops and promulgates test procedures and energy conservation standards for certain consumer appliances and commercial equipment. The Department is committed to expeditiously completing overdue or "backlog" rulemakings. A DOE report submitted to Congress on January 31, 2006,<sup>1</sup> identifies the rulemakings the Department has scheduled for completion by June 2011 and explains many of the techniques the Department will be applying to the rulemaking process in order to meet this schedule. The Department will also continue to apply the procedures set forth in the Process Rule,<sup>2</sup> to the extent that they do not inhibit the completion of the rule by the scheduled dates.

The process for developing standards involves analysis, public notice, and consultation with interested parties. Such parties, collectively referred to as stakeholders, include manufacturers, consumers, energy conservation and environmental advocates, State and Federal agencies, and any other groups or individuals with an interest in the standards.

This document is intended to inform stakeholders of the process for the standards rulemaking for the covered beverage vending machines, and to encourage and facilitate stakeholder input during the rulemaking. This document is the starting point for developing standards and is not a definitive statement with respect to any issue to be determined in the rulemaking.

Section 1 provides an overview of the rulemaking process. Sections 2 through 16 discuss analyses DOE intends to conduct to fulfill the statutory requirements and guidance for this standards rulemaking.

Information regarding this rulemaking will be maintained on the DOE website at [http://www.eere.energy.gov/buildings/appliance\\_standards/](http://www.eere.energy.gov/buildings/appliance_standards/)

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<sup>1</sup> On January 31, 2006, the Department submitted to Congress the *Energy Conservation Standards Activities*, which was submitted pursuant to section 141 of the Energy Policy Act of 2005 and to the Conference Report (109-275) to the Fiscal Year 2006, Energy and Water Development Appropriations Act. The report is available as a PDF file on the DOE webpage at: [http://www.eere.energy.gov/buildings/appliance\\_standards/2006\\_schedule\\_setting.html](http://www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html).

<sup>2</sup> *Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products* (the "Process Rule"), 61 FR 36974, 10 CFR Part 430, Subpart C, Appendix A, (July 15, 1996).

*This document contains comment boxes that highlight issues on which DOE seeks comment and requests feedback from interested parties. These boxes are also used to ask specific questions on the approaches the Department is proposing to follow in conducting the analyses required for the standards rulemaking. Such requests for stakeholder feedback are numbered according to the section in which they appear.*

## **1.1 The Appliances and Commercial Equipment Standards Program**

Part B of Title III of the Energy Policy and Conservation Act (EPCA) sets forth a variety of provisions designed to improve the energy efficiency of various products and equipment. Part B of Title III provides for the “Energy Conservation Program for Consumer Products Other Than Automobiles.” (42 U.S.C. 6291–6309)

The National Energy Conservation Policy Act (NECPA) amended EPCA to add Part C of Title III (42 U.S.C. 6311–6317), which established an energy conservation program for certain industrial equipment. Part C provides for a program similar to Part B for certain industrial equipment. The Energy Policy Act of 1992 (EPACT 1992), Public Law 102-486, included amendments to EPCA that expanded Title III to include additional commercial equipment. The recent Energy Policy Act of 2005 (EPACT 2005), Public Law 109-58, updates several existing standards and test procedures; prescribes definitions, standards, and test procedures for certain new covered products and commercial equipment; and mandates that the Secretary of Energy (the Secretary) commence rulemakings to develop test procedures and standards for certain new covered products and commercial equipment.

Due to what appears to be an error in legislative drafting, EPACT 2005 includes provisions dealing with definitions, test procedures, and energy conservation standards relating to several types of commercial equipment, including beverage vending machines, in a section that amends sections 321, 323 and 325 of Part B of Title III of EPCA (42 U.S.C. 6291, 6293, and 6295 respectively) for consumer products. The DOE anticipates that this error will be corrected through legislation, and that the provisions will become amendments to Part C of Title III of EPCA for “Certain Industrial Equipment.” 70 FR 60407 (October 18, 2005). Consistent with its previous action to incorporate the EPACT 2005 requirements for commercial equipment into Title 10 of the Code of Federal Regulations (CFR), Part 431, which covers that type of equipment, DOE intends to place the new requirements for beverage vending machines in Part 431.

Section 135(c)(4) of EPACT 2005 amends section 325 of EPCA by adding, in part, new subsections 325(v)(2), (3), and (4) (42 U.S.C. 6295(v)(2), (3) and (4)), which direct the Secretary to issue by rule, no later than August 8, 2009, energy conservation standards for refrigerated bottled or canned beverage vending machines. Such standards shall apply to beverage vending machines manufactured three years after the date of publication of a final rule that establishes energy conservation standards for that equipment.

Section 135(b) of EPACT 2005 amends section 323 of EPCA by adding, in part, new subsections 323(b)(15) (42 U.S.C. 6293(b)(15)) and 323(f) (42 U.S.C. 6293(f)), which, respectively, state that the test procedure for refrigerated bottled or canned beverage vending

machines shall be based on American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 32.1-2004, "Methods of Testing for Rating Vending Machines for Bottled, Canned or Other Sealed Beverages," and that the Secretary has until August 8, 2007, to prescribe that new test procedure.

Section 135(a)(3) of EPACT 2005 amends section 321 of EPCA by adding, in part, new subsection 321(40) (42 U.S.C. 6291(40)), which establishes the following definition:

The term "refrigerated bottled or canned beverage vending machine" means a commercial refrigerator that cools bottled or canned beverages and dispenses the bottled or canned beverages on payment.

In addition, section 136(a)(3) of EPACT 2005 amends section 340 of EPCA by replacing subsection 340(9) (42 U.S.C 6311(9)) with, in part, definitions for the following terms relating to commercial refrigeration equipment that are relevant to beverage vending machines:

(9)(A) The term "commercial refrigerator, freezer, and refrigerator-freezer" means refrigeration equipment that—

(i) is not a consumer product (as defined in section 321);

(ii) is not designed and marketed exclusively for medical, scientific, or research purposes;

(iii) operates at a chilled, frozen, combination chilled and frozen, or variable temperature;

(iv) displays or stores merchandise and other perishable materials horizontally, semivertically, or vertically;

(v) has transparent or solid doors, sliding or hinged doors, a combination of hinged, sliding, transparent, or solid doors, or no doors;

(vi) is designed for pull-down temperature applications or holding temperature applications; and

(vii) is connected to a self-contained condensing unit or to a remote condensing unit.

(B) The term "holding temperature application" means a use of commercial refrigeration equipment other than a pull-down temperature application, except a blast chiller or freezer.

\* \* \*

(D) The term "pull-down temperature application" means a commercial refrigerator with doors that, when fully loaded with 12 ounce beverage cans at 90

degrees F, can cool those beverages to an average stable temperature of 38 degrees F in 12 hours or less.

(E) The term "remote condensing unit" means a factory-made assembly of refrigerating components designed to compress and liquefy a specific refrigerant that is remotely located from the refrigerated equipment and consists of 1 or more refrigerant compressors, refrigerant condensers, condenser fans and motors, and factory supplied accessories.

(F) The term "self-contained condensing unit" means a factory-made assembly of refrigerating components designed to compress and liquefy a specific refrigerant that is an integral part of the refrigerated equipment and consists of 1 or more refrigerant compressors, refrigerant condensers, condenser fans and motors, and factory supplied accessories.

EPACT 2005 does not explicitly define the terms “self-contained commercial refrigerator, freezer, or refrigerator-freezer” and “remote condensing commercial refrigerator, freezer, or refrigerator-freezer.” The Department construes these two terms to mean “commercial refrigerator, freezer, or refrigerator-freezer that is connected to a self-contained condensing unit” and “commercial refrigerator, freezer, or refrigerator-freezer that is connected to a remote condensing unit,” respectively.

As presented above, section 135(a)(3) of EPACT 2005 defines a “refrigerated bottled or canned beverage vending machine,” in part, as equipment that cools bottled or canned beverages and dispenses them on payment. The Department is considering defining the terms “bottled beverage” and “canned beverage” in a manner that is consistent with the definitions for “bottle” and “can” established in ANSI/ASHRAE Standard 32.1-2004, which are:

***bottle:*** a glass or plastic container in which a beverage is sealed.

***can:*** a container made of metal or paperboard or a combination of both in which a beverage is sealed.

The Department expects that such broad definitions for “bottled beverage” and “canned beverage” would allow for more comprehensive coverage of existing beverage vending machine equipment, and particularly of certain types of equipment that are currently experiencing market growth.

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| <p><i>Item 1-1 The Department requests feedback on this approach to defining the terms “bottled beverage” and “canned beverage.”</i></p> |
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## **1.2 Overview of the Rulemaking Process**

### **1.2.1 Test Procedures**

The Department is developing test procedures and testing requirements for the beverage vending machines covered under this rulemaking, as mandated in EPACT 2005 and discussed in



section 1.1 above, in a separate rulemaking. As required by EPACT 2005, the test procedure under consideration for the beverage vending machines covered under this rulemaking is the ANSI/ASHRAE Standard 32.1-2004, “Methods of Testing for Rating Vending Machines for Bottled, Canned, and Other Sealed Beverages.”

### **1.2.2 Rulemaking Process and Stakeholder Participation**

Under EPCA, when DOE is studying new or amended standards, it must consider to the greatest extent practicable: (1) the economic impact of the standard on the manufacturers and consumers of the affected products; (2) the savings in operating costs throughout the estimated average life of the product compared to any increases in the initial cost or maintenance expense; (3) the total projected amount of energy savings likely to result directly from the imposition of the standard; (4) any lessening of the utility or the performance of the products likely to result from the imposition of the standard; (5) the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard; (6) the need for national energy conservation; and (7) other factors the Secretary considers relevant. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(e), added by section 136(h)(3) of EPACT 2005) Other statutory requirements are set forth in 42 U.S.C. 6295(o)(1)–(2)(A), (2)(B)(ii)–(iii), and (3)–(4), and 42 U.S.C. 6316(e).

The Department considers stakeholder participation to be a very important part of the process for setting energy conservation standards. The Department actively encourages the participation and interaction of all stakeholders during the comment period in each stage of the rulemaking. Beginning with the framework document and every subsequent comment period, interactions among stakeholders provide a balanced discussion of the information that is required for the standards rulemaking.

In conducting the test procedures and the energy conservation standards rulemakings, the Department involves stakeholders through a variety of means, including formal public notifications (i.e., Federal Register notices). The standards rulemaking process involves three formal, major public notices, which are published in the Federal Register. The first of the rulemaking notices is an advance notice of proposed rulemaking (ANOPR, see section 1.3). The ANOPR is designed to publicly vet the models and tools used in the rulemaking, and to facilitate public participation before the proposed rule stage. The second notice is a notice of proposed rulemaking (NOPR, see section 1.4), which presents a discussion of comments received in response to the ANOPR; analysis of the impacts of standards on consumers, manufacturers, and the Nation; the Department’s weighting of the impacts; and the proposed standards. The third notice is the final rule (see section 1.5), which presents a discussion of comments received in response to the NOPR, the revised analysis of the impacts of standards, the Department’s weighting of the impacts, the standards adopted by DOE, and the effective dates of the standards.

### **1.3 Advance Notice of Proposed Rulemaking**

As part of its initial rulemaking activities, the Department typically identifies the product design options or efficiency levels that it will analyze in detail, and those it should eliminate from further consideration. This process includes a market and technology assessment (see section 3) and a screening analysis (see section 4). These activities include consultations with stakeholders

and independent technical experts who can assist with identifying the key issues and design options or efficiency levels to be considered by the Department in the rulemaking.

At the start of the ANOPR analysis, the Department considers efficiency levels for each product class. The Department uses these efficiency levels to collect manufacturer cost data, historical shipment data, shipment-weighted average efficiency data, and preliminary manufacturer impact data (e.g., capital conversion expenditures, marketing costs, research and development costs). During the ANOPR stage, DOE presents consumer life-cycle cost (LCC) impact and payback period results (see section 8), national energy savings (NES) and consumer net present value (NPV) results (see section 10) for a range of efficiency or energy-use levels, and a preliminary manufacturer impact analysis (MIA) (see section 12).

The Department's selection of efficiency or energy-use levels to analyze is based on the costs and benefits of efficiency levels or design options. The Department generally selects levels or design options for consideration that span the full range of technologically achievable efficiencies, specifically including:

1. The highest energy efficiency level or lowest energy consumption level that is technologically feasible (the "max-tech" level);
2. The level with the lowest LCC; and
3. Levels that incorporate noteworthy technologies or fill in large gaps between efficiency levels considered.

The efficiency or energy-use levels analyzed serve to demonstrate the functions and outputs of the models and tools. During the ANOPR, models and tools are tested for the different product classes at each efficiency or energy-use level analyzed. In addition, preliminary ANOPR results may facilitate negotiations among interested parties.

The Department will make the results of the analyses available on its website for review and will consider comments on them after the publication of the ANOPR. When the Department publishes the ANOPR, the Department will also make available a technical support document (TSD) containing the details of all the analyses performed to date.

#### **1.4 Notice of Proposed Rulemaking**

After the publication of the ANOPR, there is a 75-day public comment period and a public meeting. At this point, the Department encourages stakeholders to develop joint recommendations for standard levels.

After the ANOPR, DOE will conduct further economic impact analyses. These analyses may include refinements of previous analyses, and will include a consumer LCC sub-group analysis (see section 11), a manufacturer impact analysis (see section 12), a utility impact analysis (see section 13), an employment impact analysis (see section 14), an environmental assessment (see section 15), and a regulatory impact analysis (see section 16).

The Department will make the results of all the analyses available on its website for review and will consider comments after the publication of the NOPR. This review and comment process may result in revisions to the analyses. This analytical process ends with the selection of proposed energy conservation levels that will be presented in the NOPR. The Department selects the proposed standard levels from the trial standard levels analyzed. The NOPR, published in the Federal Register, will document the evaluation and selection of any proposed standards.

For each product class, the Department will identify the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible. If the Department proposes a level that is below this “max-tech” level, it will explain the reasons for eliminating higher levels beginning with the highest level considered. The Department will present the results of the analysis in the NOPR and the details of the analysis in an accompanying TSD.

The Department considers many factors in selecting proposed standards. These factors or criteria are established by statute and capture the many benefits, costs, and impacts of the standards. Additionally, the Department encourages stakeholders to develop joint recommendations for standard levels. The Department will carefully consider such recommendations in its decision process.

When the Department publishes the NOPR, it will provide the Department of Justice (DOJ) with a copy of the NOPR and TSD and will solicit feedback on the impact of the proposed standard levels on competition. The DOJ will review these standard levels in light of any lessening of competition that is likely to result from the imposition of standards. The Department will consider DOJ’s determination on the impacts of the proposed standard on competition in preparing the final rule. The NOPR is followed by a 75-day public comment period that includes a public meeting.

## **1.5 Final Rule**

Revisions to the analyses may result from the public comments on the NOPR. On the basis of the public comments, DOE will review the engineering and economic impact analyses and proposed standards and make modifications as necessary.

After the publication of the NOPR, the Department will conduct a thorough review of all analyses performed, and of the trial standard levels. Final revisions to the analyses and trial standard levels will be made as appropriate.

Before the final rule is issued, the Department will consider DOJ comments on the NOPR relating to the impacts of the proposed standard levels on competition to determine whether changes to these standard levels are needed.

The standards rulemaking will conclude with the publication of the final rule. The Department will select the final standard levels based on the complete record of the standards rulemaking. The final rule will promulgate the final standard levels and their effective date and explain the basis for their selection. The final rule will be accompanied by a final TSD.

## 1.6 Overview of Beverage Vending Machines

Refrigerated bottled or canned beverage vending machines can be divided into categories either by machine-use designation (indoor/outdoor use or indoor-use-only) or door type (solid door or glass-fronted). The classification of the beverage vending machines by machine-use designation of indoor/outdoor use and indoor-use-only are explained in detail in sections 1.6.1 and 1.6.2, respectively. Both classes of beverage vending machines are commonly found in numerous public spaces, including retail spaces, private offices, schools, and other institutions.

### 1.6.1 Beverage Vending Machines for Indoor/Outdoor Use

The most common beverage vending machine that is intended for both indoor and outdoor use is the solid-door machine. With solid-door machines, the products contained are typically advertised on the front via signage or a backlit panel and the actual machine contents are not visible to the user. These machines<sup>3</sup> are typically designed to be placed outdoors and withstand weather effects. Some glass-fronted machines are also placed outdoors in sheltered or protected locations limited only by concerns of vandalism and damage. These machines are marked "Suitable for Outdoor Use" or "Suitable for Protected Locations" in accordance with Underwriters Laboratories (UL) Standard 541-2003, "Refrigerated Vending Machines."

A small number of the solid-door beverage vending machines are classified as having a "live display" door type, where a sample of the product is visible to the consumer through a small window. These "live-display" machines represent a small fraction of the total market.

*Item 1-2 The Department seeks feedback on the terminology "indoor/outdoor use" for beverage vending machines. What types of beverage vending machines are designed for indoor/outdoor use?*

### 1.6.2 Beverage Vending Machines for Indoor-Use-Only

Although solid-door beverage vending machines can be found indoors as well, the beverage vending machines intended for indoor-use-only are dominated by glass-front models. These machines are found primarily indoors because the glass fronts make them vulnerable to vandalism in addition to introducing the problem of solar gain and heat loss through the glass front. These machines are marked "For Indoor Use Only" in accordance with UL Standard 541-2003, "Refrigerated Vending Machines." The glass-fronted vending machines are also known as multi-package vending machines. This design allows the consumer to see the products inside the machine—commonly displayed on shelves—with some models displaying as many as 45 different varieties of drinks. Product packaging is not limited to cans and bottles, and may also include cartons, juice packs, and non-standard bottle and can shapes. Dispensed mechanically, many machines have a mechanism to move the product to the door gently rather than dropping the beverage from the upper shelves.

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<sup>3</sup> Depending on the model, these machines can contain up to 800 cans and up to 12 varieties of beverages.

With the increasing market for non-carbonated soft drinks, such as energy drinks, fruit juices and water (which come in a variety of packaging types and sizes), these machines provide a much wider choice for the consumer.

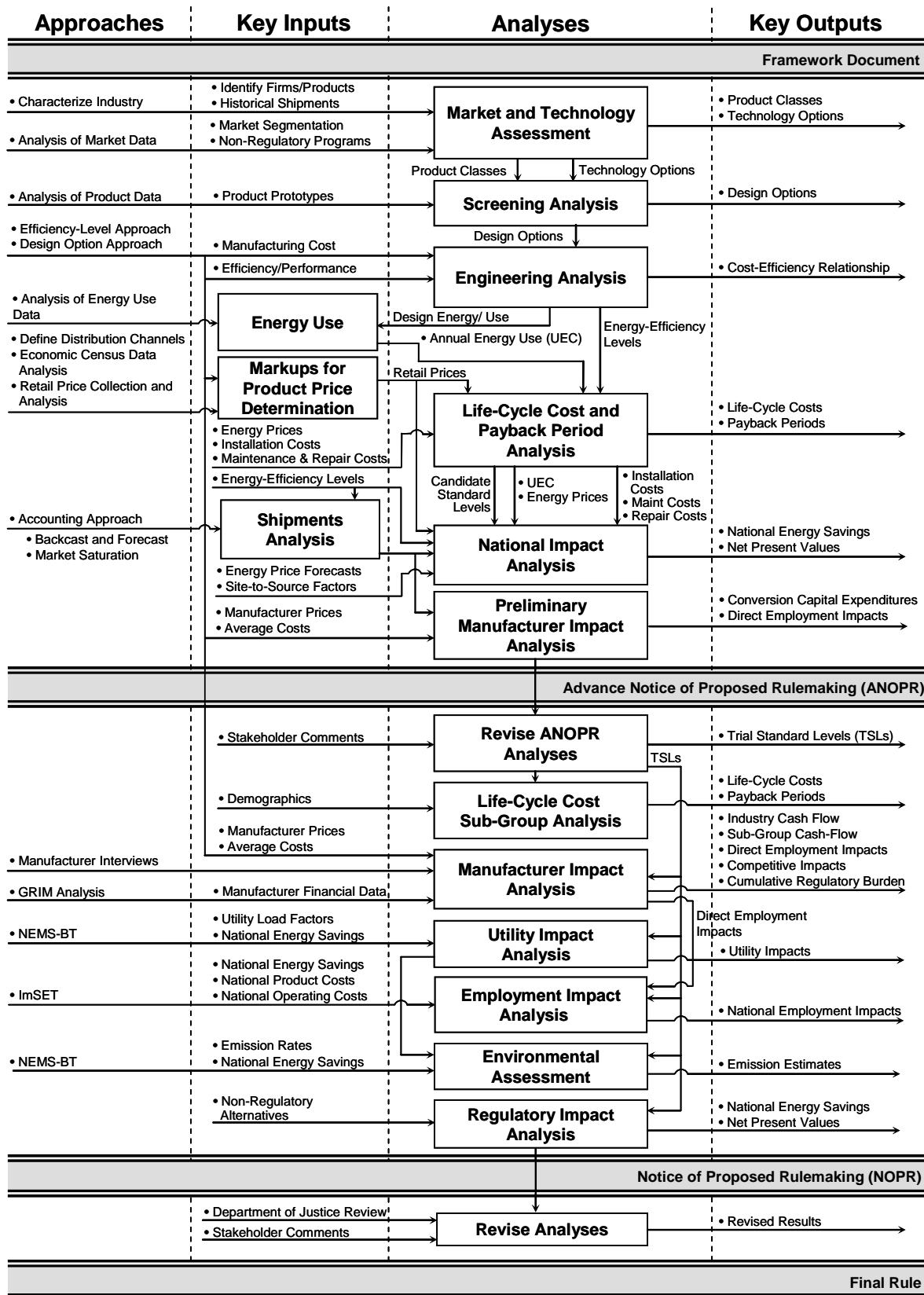
*Item 1-3 The Department seeks feedback on the terminology “indoor-use-only” for beverage vending machines. What types of beverage vending machines are designed for indoor-use-only?*

## **2 ANALYSES FOR RULEMAKING**

Ultimately, the Department intends to select energy conservation standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. The selection of such standards is expected to achieve the maximum energy savings that are economically justified without putting an unjust financial burden on any particular party. Economic justification includes consideration of the economic impacts on domestic manufacturers and consumers, national benefits including environmental impacts, issues of consumer utility, and impacts from any lessening of competition. The purpose of the analyses conducted in support of the standards rulemaking will be to insure that the final standards meet these criteria of technological feasibility and economic justification.

This section offers an overview of DOE’s analytical methodology and discusses the major components of the analyses DOE will conduct. A consistent approach to the analyses throughout the rulemaking will be ensured through the consideration of each analysis as a part of the overall standards-setting framework.

Figure 1 summarizes the analytical components of the standards-setting process. The analyses are presented in the center column. Each analysis has a set of key inputs, which are data and information required for the analysis. “Approaches” are the methods that will be used to obtain key inputs. For example, some key inputs exist in public databases, some will be collected from stakeholders or others with special knowledge, and some will be developed by the project team in support of the rulemaking. The results of each analysis are key outputs, which feed directly into the rulemaking. Dotted lines connecting one analysis to another indicate the flow of information.



**Figure 1. Flow Diagram of Analyses for the Beverage Vending Machine Standards Rulemaking Process**

### 3 MARKET AND TECHNOLOGY ASSESSMENT

The market and technology assessment will provide information about the beverage vending machine industry that the Department will use throughout the rulemaking. This assessment is particularly important at the outset of the rulemaking to determine product classes and to identify potential design options or efficiency levels for each product class.

#### 3.1 Market Assessment

The Department will qualitatively and quantitatively characterize the structure of the beverage vending machine industry and market. In the market assessment, the Department will identify and characterize the manufacturers of this equipment; estimate market shares and trends in the market; address regulatory and non-regulatory initiatives intended to improve the energy efficiency or reduce the energy consumption of the beverage vending machines covered under this rulemaking; and explore the potential for technological improvements in the design and manufacturing of such equipment.

The National Automatic Merchandising Association (NAMA) is the trade association for manufacturers of equipment covered under this rulemaking, and the American Beverage Association (ABA) is the trade association for the bottlers and syrup companies in the beverage industry. The Department expects that NAMA and ABA will play a critical role in providing market information, including input on characterizing current and historical trends in equipment shipments and energy efficiency.

As stated above, the collected information will serve as a resource for use throughout the rulemaking. For example, the Department will use historical equipment shipments and prices as an aid in creating shipment scenarios and predicting future prices. Market structure data will be particularly useful for assessing competitive impacts as part of the manufacturer impact analysis.

The beverage vending machines covered under this rulemaking have never before been the subject of energy conservation regulations at the Federal level. The Department understands that some limited data on energy consumption and energy efficiency is available for this equipment. In addition, a preliminary investigation by the Department indicates that there is little or no publicly available data on the cost of manufacturing this equipment, manufacturers' market shares, shipments, or channels of distribution. Such data is essential to the development of technologically feasible and economically justified energy conservation standards. Stakeholders are therefore encouraged to submit any available, applicable data to the Department for consideration.

*Item 3-1 The Department seeks information that would contribute to the market assessment (e.g., the manufacturers of this equipment in the United States and the products they sell, by product class). It is particularly important that the Department be aware of the major and small/niche manufacturers.*

*Item 3-2 The Department seeks information on annual product shipments from 1990 to 2005 (both domestic and imports), and the corresponding shipment-weighted average daily energy consumption of these shipments.*

## 3.2 Product Classes

The Department intends to separate the beverage vending machines covered under this rulemaking into product classes. The criteria for separation into different classes are: type of energy used and vendible capacity and/or other performance-related features, such as those that provide utility to the consumer, or others deemed appropriate by the Secretary, which justify the establishment of a separate energy conservation standard. (42 U.S.C. 6295(q) and 6316(e) added by section 136(h)(3) of EPACT 2005)

The Department proposes the product classes listed below, defined according to equipment use designation and physical characteristics such as door-type.

1. Beverage vending machines for indoor/outdoor use
  - (a) solid-door
  - (b) glass-fronted
2. Beverage vending machines for indoor-use-only
  - (a) solid-door
  - (b) glass-fronted

*Item 3-3 The Department seeks comments on the proposed classes for beverage vending machines, and on the criteria used in creating the classes. Are the proposed product classes appropriate? For instance, is the distinction between solid-door and glass-fronted door machines necessary?*

*Item 3-4 What product classes, if any, can be combined for standards-setting purposes because of their similarities?*

*Item 3-5 Are any of these product classes extensible (i.e., can analyses performed for one product class be applied or extrapolated to another product class)?*

*Item 3-6 Should all of these product classes be considered (e.g., do any of these product classes have few or no shipments)?*

The standards established by the California Energy Commission (CEC), the ENERGY STAR specifications established by the U.S. Environmental Protection Agency (EPA), and the regulations established by the Canadian Standards Association for these beverage vending machines take the form of upper limits on daily energy consumption as a function of the vendible capacity. The Department is considering using a similar test metric in establishing energy conservation standards for the covered equipment.

*Item 3-7 The Department requests feedback on the use of a similar, vendible-capacity-based daily energy consumption metric for beverage vending machines.*



### **3.3 Technology Assessment**

The Department typically uses information about existing and past technology options and prototype designs as input in identifying baseline units (see section 3.4) for the engineering analysis and technologies manufacturers could use to attain higher energy efficiency levels. In consultation with interested parties, the Department intends to develop a list of technologies that should be considered in the analysis. Initially, this list will include all those technologies considered to be technologically feasible and will serve to establish the maximum technologically feasible design. In the screening analysis, DOE will eliminate from consideration technologies that have not been incorporated in commercial equipment or in working prototypes, or that fail to meet certain criteria as to practicability to manufacture, install, and service, as to impacts on product utility or availability, or as to health or safety. (Process Rule, sections 4(a)(4) and 5(b))

The Department is collecting information on technologies that could be used to improve the energy efficiency of beverage vending machines. The Department is currently considering the specific technologies and designs listed below.

**The following technologies and designs are relevant to all product classes:**

1. Higher efficiency signage lighting (e.g., T8 fluorescent lamps, light-emitting diodes (LEDs));
2. Higher efficiency lighting ballasts (e.g., electronic ballasts);
3. Remote lighting ballast location (i.e., outside the refrigerated space);
4. Higher efficiency expansion valves (e.g., dual-port thermostatic expansion valves (TXVs) and electronic expansion valves (EEVs));
5. Higher efficiency evaporator fan motors (e.g., electronically commutated motors (ECMs));
6. Increased evaporator surface area or efficiency to achieve lower case-evaporator temperature differential (with a possible increase in fan energy);
7. Evaporator-fan-motor controllers;
8. Higher efficiency evaporator fan blades;
9. Low-pressure-differential evaporators;
10. Anti-sweat heater controls;
11. Machine-insulation increases or improvements;
12. Defrost mechanism (e.g., hot-gas defrost);

13. Defrost-cycle control (e.g., partially or fully demand-based defrost rather than partially or fully time-based defrost);
14. Higher efficiency compressors (e.g., variable-speed compressors);
15. Liquid-to-suction heat exchanger (LSHX) (subcool liquid refrigerant with suction line);
16. Increased condenser surface area or efficiency to achieve lower ambient-condenser temperature differential;
17. Higher efficiency condenser fan motors (e.g., electronically commutated motors (ECM));
18. Condenser-fan-motor controllers; and
19. Higher efficiency condenser fan blades.

*Item 3-8 What technologies or designs, if any, should be added to or removed from the above list?*

*Item 3-9 What technologies or designs, if any, should be treated individually, or be incorporated into a few standard "design packages"? If "design packages" are possible, how should the packages be assembled?*

### **3.4 Baseline Units**

Once the Department establishes product classes, it will select a baseline model as a reference point for each product class, against which it can measure changes resulting from energy conservation standards. The baseline model in each product class represents the characteristics of equipment in that class, e.g., the vendible capacity. Typically, a baseline model would be a model that just meets current required energy conservation standards. Because there are no existing standards for the beverage vending machines covered under this rulemaking, the Department will select baseline models using a different method (e.g., the unit with the highest energy consumption or the typical unit). The Department proposes to use information provided by stakeholders in selecting appropriate baseline models. The ENERGY STAR Tier 1 voluntary standard could be used as the baseline, since the largest manufacturers are well on their way to manufacturing and selling primarily equipment that meets or exceeds this level. Note that the CEC required that all beverage vending machines meet this level as of January 1, 2006.

*Item 3-10 The Department seeks feedback on how to select a baseline model for each product class.*

*Item 3-11 Is the ENERGY STAR Tier 1 level appropriate for the baseline model?*

The Department will use the baseline models in the engineering analysis and the life-cycle-cost and payback-period analyses. To determine energy savings and changes in price, the Department will compare a model with a higher energy efficiency or a lower energy consumption with the baseline model.

*Item 3-12 Given that the cost of improving efficiency in order to meet a new standard may vary with machine capacity, should there be a specific capacity for the baseline model? What should be the capacity of the baseline model for each product class?*

*Item 3-13 The Department seeks information on what particular components and features characterize the baseline model in each product class (e.g., materials, dimensions, insulation, refrigerant type, compressors, evaporators, condensers, expansion devices, fans, motors, anti-condensate devices and controls, defrost mechanisms and controls, lighting, etc.).*

#### **4 SCREENING ANALYSIS**

The purpose of the screening analysis is to screen out design options that will not be considered in the rulemaking for beverage vending machines.

In consultation with interested parties, the Department will develop a list of design options for consideration. Initially, the design options will encompass all those technologies considered to be technologically feasible. Following development of this initial list of design options, the Department will review each design option based on the following four criteria, as addressed in sections 4(a)(4) and 5(b) of the Process Rule:

1. *Technological feasibility.* Technologies that are not incorporated in commercial products or in working prototypes will not be considered further.
2. *Practicability to manufacture, install, and service.* If it is determined that mass production of a technology in commercial products and reliable installation and servicing of the technology could not be achieved on the scale necessary to serve the relevant market at the time of the effective date of the standard, then that technology will not be considered further.
3. *Impacts on product utility to consumers.* If a technology is determined to have significant adverse impact on the utility of the product to significant subgroups of consumers, or result in the unavailability of any covered product type with performance characteristics (including reliability), features, size, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.
4. *Safety of technologies.* If it is determined that a technology will have significant adverse impacts on health or safety, it will not be considered further.

The reasons for eliminating any design options during the screening analysis will be fully documented and published as part of the ANOPR.

## **5 ENGINEERING ANALYSIS**

After conducting the screening analysis, the Department performs an engineering analysis based on the remaining design options. Potentially, as a result of screening out some design options which may enable the achievement of the highest efficiencies, the Department may, in effect, be limiting the efficiency levels considered in the engineering analysis. The engineering analysis consists of estimating the costs of equipment at various levels of increased energy efficiency or reduced energy consumption. This section provides an overview of the engineering analysis (section 5.1), and discusses: the approach for determining the cost-efficiency relationship (section 5.2); manufacturer prices (section 5.3); proprietary designs (section 5.4); and regulatory changes that affect the engineering analysis (section 5.5) other than the Department's energy conservation standards process.

### **5.1 Engineering Analysis Overview**

The purpose of the engineering analysis is to determine the relationship between manufacturer selling price and energy efficiency for beverage vending machines. In determining this relationship, the Department will estimate the increase in manufacturer selling price associated with technological changes that increase the efficiency of the baseline models.

The Department will obtain cost estimates for the engineering analysis (which it will also use in the manufacturer impact analysis) from detailed incremental cost data disaggregated into the cost of incremental material, labor, and overhead. The Department will create an industry-wide analysis based primarily on the manufacturer-supplied data. The Department may supplement this analysis with cost estimates of specific design options.

Therefore, the Department seeks design, efficiency, and cost information to determine the cost of improving the efficiency of the baseline model. In addition, the Department must identify the model with the highest efficiency that is technologically feasible within each product class (i.e., the "max-tech" model).

*Item 5-1 For each product class, the Department seeks information on incremental manufacturing costs and components (see Item 3-13) for four energy-efficiency levels above the baseline (e.g., daily energy consumption, components that differ from the baseline, material costs,<sup>4</sup> labor costs,<sup>5</sup> overhead costs<sup>6</sup> (excluding depreciation), building conversion capital expenditures, tooling/equipment conversion capital expenditures, research and development (R&D) expenses, marketing expenses, etc.).*

*Item 5-2 The Department is also interested in any equipment test data that stakeholders can provide (e.g., test procedures used, rating conditions, equipment parameters, test results, etc.). Test data for the baseline model in each product class is particularly important.*

## **5.2 Proposed Approach for Determining the Cost-Efficiency Relationship**

In support of this rulemaking effort, the Department seeks to collect incremental cost data. The data are intended to represent the average incremental production cost to improve a baseline model to a specified efficiency level. The Department will aggregate the data by weighting each individual data point by company-level sales volumes for each product class. This methodology constitutes an efficiency-level approach to the engineering analysis because the Department will examine aggregated incremental increases in manufacturer selling price at specified levels of energy efficiency.

To be useful in the manufacturer impact analysis, manufacturer cost information should reflect the variability in baseline models, design strategies, and cost structures that can exist among manufacturers. The Department will attempt to qualify the aggregated cost-efficiency data supplied by stakeholders through engineering expertise and consultation with stakeholders or technical experts. Specifically, the Department will supplement these aggregated cost data with information obtained through follow-up manufacturer interviews. These confidential interviews will provide a deeper understanding of the various combinations of technologies used to increase equipment efficiency, and their associated manufacturing costs.

If the Department is unable to reconcile information collected during the manufacturer interviews with the aggregated cost data, or with information contained in the market and technology assessment, the Department will supplement the manufacturer-provided data through

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<sup>4</sup> Costs of raw materials including scrap that can be traced to final or end products. Direct material costs do not include indirect material costs, which are attributed to supplies that may be used in the production process but are not assigned to final products (e.g., lubricating oil for production machinery).

<sup>5</sup> The earnings of workers who assemble parts into a finished good or operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as overtime pay. Direct labor does not include indirect labor, which is defined as the earnings of employees who do not work directly in assembling a product, such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.

<sup>6</sup> Factory overhead excluding depreciation. Factory overhead includes indirect labor, downtime, set-up costs, indirect material, expendable tools, maintenance, property taxes, insurance on assets, and utility costs. Factory overhead does not include selling, general, and administrative costs (SG&A); research and development costs (R&D); interest; or profit (accounted for by the Department separately).

a design-options approach involving consultation with outside experts and/or further review of publicly available cost and performance information.

The Department will estimate the contribution of the depreciation of conversion capital expenditures to the incremental overhead. During the interviews, the Department will gather information about the capital expenditures that would be necessitated by increasing the efficiency of the baseline models to various efficiency levels (i.e., conversion capital expenditures by efficiency or energy use level). The Department will also request information about the depreciation method used to expense the conversion capital.

The approach proposed above will allow the Department to represent beverage vending machines throughout the entire efficiency range without depending on time-consuming simulation modeling. The Department will maintain the confidentiality of proprietary data while allowing the public to examine the cost and design assumptions that underlie the cost-efficiency estimates.

*Item 5-3 The Department requests feedback on the use of an efficiency-level approach to determining the relationship between manufacturer selling price and energy efficiency for beverage vending machines, supported, as needed, by a design-options approach.*

### **5.3 Manufacturer Prices**

The Department plans to apply markups to convert manufacturer production costs to manufacturer selling prices. The Department will estimate manufacturer markups from publicly available financial information (e.g., Securities and Exchange Commission 10-K reports).

*Item 5-4 The Department seeks comment on the markup approach proposed for developing estimates of manufacturer selling prices.*

### **5.4 Proprietary Designs**

The Department will consider in its engineering and economic analyses all design options that have not been screened out, including proprietary designs. The Department will consider a proprietary design in the subsequent analyses only if it is not a unique path to a given efficiency level. If the proprietary design is the only approach available to achieve a given efficiency level, then DOE will reject the efficiency level (that can only be achieved by a proprietary design) from further analysis. Furthermore, the Department is sensitive to manufacturer concerns regarding proprietary designs and will make provisions to maintain the confidentiality of any proprietary data submitted by manufacturers. This information will provide input to the competitive impacts assessment and other economic analyses.

*Item 5-5 Are there proprietary designs that the Department should consider for any of the products under consideration by this rulemaking? If so, how should the Department acquire the cost data necessary for evaluating these designs?*

## 5.5 Regulatory Changes Affecting the Engineering Analysis

In conducting an engineering analysis, the Department must consider the effects of regulatory changes that can impact the manufacturers of the covered equipment outside the Department's statutory energy conservation standards rulemaking process. Some of these changes can also affect the energy efficiency or energy consumption of the covered equipment. For example, due to the phase-out of hydrochlorofluorocarbons (HCFCs), the beverage vending machine industry must transition to non-ozone-depleting refrigerants. As a result, the industry will likely use hydrofluorocarbon-based (HFC-based) refrigerants in its products.

The Department will attempt to identify all such regulatory issues that could impact the engineering analysis. The consideration of these issues is closely related to the cumulative regulatory burden assessment that the Department will carry out as part of the manufacturer impact analysis.

Based on consideration of the comments received for the ANOPR, DOE will make the necessary changes to the analysis. These changes will be reflected in the documentation of the NOPR.

*Item 5-6 Are there additional regulatory issues that the Department should consider in its analysis of beverage vending machines?*

## 6 ENERGY USE CHARACTERIZATION

The purpose of the energy use characterization analysis is to assess the energy savings potential of different equipment designs across a range of climate zones where the equipment is used. As part of the energy use analysis, certain engineering assumptions must be made regarding equipment application, including where the equipment is located (outdoor versus indoor). Characterizing the energy use of beverage vending machines is a critical part of the standards rulemaking analysis as it establishes the per-unit energy savings potential achievable from energy efficiency standards.

Although many beverage vending machines are located inside conditioned spaces, a relatively small number of machines are typically installed in an individual building. It is recognized that beverage vending machines will add to the cooling load and reduce the heating load during winter months, but these impacts are believed to be fairly modest in most cases. Furthermore, the Department believes the added complexity of determining the overall impact to the building space-conditioning loads is not worth the effort involved in accurately quantifying this effect, particularly given the variety of building types and of the vending machine locations (e.g., outside, inside, or in vestibules) that would need to be taken into account.

*Item 6-1 Is the assumption that the beverage vending machine operation has a negligible impact on the building space-conditioning loads a valid assumption?*

*Item 6-2 How should the Department consider energy use in "heating mode" for outdoor machines in cold climates?*

Studies conducted by Arthur D. Little, Inc., the Environmental Protection Agency, Canadian Standards Association, and Australian National Appliance and Equipment Energy Efficiency Program provide some information on the unit energy consumption of existing machines.

*Item 6-3      Because of the age of some of this data, the Department requests stakeholders to submit current field measured data on unit energy consumption of existing machines.*

## **7      MARKUPS FOR EQUIPMENT PRICE DETERMINATION**

The Department uses manufacturer-to-consumer markups to convert the manufacturer-selling-price estimates from the engineering analysis to consumer prices, which are then used in the LCC and payback period analysis and the MIA. Retail prices are needed for the baseline efficiency level and all other efficiency levels under consideration. The Department will obtain these retail prices by applying manufacturer-to-consumer markups to the manufacturer-selling-price estimates. To qualify these markups, the Department will attempt to collect data on existing prices in the market either by purchasing large data sets or by downloading data from distributor Internet sites.

Before it can develop markups, the Department must identify distribution channels (i.e., how the equipment is distributed from the manufacturer to the consumer). Once it establishes proper distribution channels for each of the product classes, DOE will rely on economic data from the U.S. Bureau of the Census (the Bureau) and input from the industry to define how products are marked up from the manufacturer to the consumer. To the extent possible, the Department also will use collected retail price data to help quantify overall manufacturer-to-consumer markups.

This analysis will generate retail prices for each possible efficiency level. Because it expects to generate a range of price estimates, the Department plans to describe new retail prices within a range of uncertainty. If the range of retail prices for the equipment is large enough, the Department will conduct a sensitivity analysis to determine how high or low estimates of retail price impact the economic feasibility of amended energy conservation standards.

In the beverage vending machine industry, the Department understands that the distribution chains are as follows:

1. Equipment Manufacturer → Vending Machine Operator (e.g., bottler, beverage distributor)
2. Equipment Manufacturer → Distributor → Vending Machine Operator
3. Equipment Manufacturer → Site Owner
4. Equipment Manufacturer → Distributor → Site Owner

In the first distribution-chain scenario, the equipment manufacturer manufactures the equipment to meet the machine performance specifications provided by the beverage company and sells it



directly to the vending machine operator who is either a bottler or a beverage distributor. The vending machine operator owns the machine, places it on-site through a “location contract,” maintains the machine and stocks it, and receives a certain percentage of coin-box revenue. The site owner, in this case, allows the machine to be placed on-site, receives a percentage of coin-box and/or other remuneration, and most importantly, pays the electric bill. In the second scenario, the vending machine operator purchases the equipment from a distributor instead of directly from the equipment manufacturer. In the third scenario, a site owner (e.g., large retail store chain) may purchase the vending machines directly from the manufacturer. Certain others (e.g., gas stations) (as in the fourth scenario) may purchase the vending machines from a distributor. In both the third and fourth scenarios, the site owner maintains and stocks the machines for the entire coin-box revenue.

The current market structure in the first scenario creates a “split-incentive system” where bottling companies or distributors purchase a significant portion of the vending machines from the equipment manufacturers and place them in locations where they do not pay the utility bills associated with their operation. The site owner may sometimes be paid a commission as part of the location contract to defray part of the electric bill for which they are responsible. There can be, therefore, a lack of an economic incentive for improved energy efficiency on the part of the equipment purchaser. Irrespective of the split-incentive system, the Department understands that there may be a growing market for energy-efficient beverage vending machines. This may be caused by two factors: environmentally conscious beverage companies “pushing” to install energy-efficient machines, and certain site owners demanding that energy-efficient machines be installed to reduce their energy costs.

The Department intends to use the data gathered from stakeholders to develop both average markups for wholesalers of the equipment as well as incremental markups. Incremental markups assume that certain industry costs, such as labor and building occupancy expenses, do not increase with an increase in cost of goods sold, but that other costs would scale with cost of goods sold. The Department will develop both the average and incremental markups in the LCC analysis, and base the LCC analysis on the incremental markups developed.

*Item 7-1 The Department requests information on the distribution paths described above for the beverage vending machines covered under this rulemaking. The Department also requests information on the relative fractions of shipments expected for each path in the overall distribution chain for beverage vending machines.*

*Item 7-2 The Department requests information on how the overall markups for the beverage vending machines covered under this rulemaking may vary for each path (or sub-path) in the distribution chain.*

*Item 7-3 The Department requests feedback on its proposal to use incremental distribution chain markups for the LCC analysis.*

*Item 7-4 The Department seeks comment on other sources of relevant data that could be used to characterize markups for the beverage vending machine industry.*

## 8 LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS

### 8.1 Overview

The effects of new energy conservation standards on equipment result in changes in operating expenses—usually a decrease—and changes in purchase price—usually an increase. In the past, the Department has analyzed the net effect of new standards on consumers by evaluating the net LCC using the cost-efficiency relationship derived in the engineering analysis, as well as the energy costs derived from the energy-use-characterization analysis. Inputs to the LCC calculation include the installed cost to the consumer (purchase price plus installation cost), operating expenses (energy expenses and maintenance costs), the lifetime of the appliance, and a discount rate. In addition, there is a specific time in the life of higher-than-baseline-efficiency equipment when the net-operating-cost-benefit (in dollars) from the time of purchase is equal to the incremental first cost of purchasing the higher efficiency equipment. The length of time required for equipment to reach this cost-equivalence point is known as the payback period.

For the ANOPR, the Department will conduct the LCC and payback period analysis using typical values to reflect the conditions in the field for equipment life, equipment retail price, national or regional energy costs, energy consumption, and discount rates. If the Department determines that there is significant variability in any of the above inputs, it will conduct sensitivity analyses to determine how high and low estimates for each of the inputs affect the LCC and payback period. For any sensitivity analyses it conducts, the Department will account for correlations that may exist between inputs (e.g., there may be a correlation between energy usage and energy prices). The life-cycle-cost subgroup analysis will be conducted for the NOPR and will include an assessment of impacts on subgroups of consumers.

For beverage vending machines, it will be necessary to determine several values for the LCC estimation, including retail prices; electricity prices; discount rate; maintenance, service and installation costs; and equipment lifetimes. The following sections discuss the methodologies the Department plans to use in determining these values.

### 8.2 Energy Prices

The Department will review the Energy Information Administration's (EIA's) energy price data for the commercial sector as a means of establishing electricity prices. The Department's inclination is to rely on regional average energy price data for the commercial sector. The Department will use projections of these energy prices for commercial consumers to estimate future energy prices in its life-cycle cost and payback period analysis. The Department will use EIA's *Annual Energy Outlook (AEO)* as the default source of projections for future energy prices.

*Item 8-1 The Department seeks comment on the proposed approaches for estimating current and forecasted energy prices.*

### 8.3 LCC Discount Rates

The calculation of consumer LCCs requires the use of an appropriate discount rate. For beverage vending machines, the Department intends to use the same approach that it used for developing discount rates for commercial unitary air conditioners and distribution transformers. (See [http://www.eere.energy.gov/buildings/appliance\\_standards/commercial/ac\\_hp.html](http://www.eere.energy.gov/buildings/appliance_standards/commercial/ac_hp.html) and [http://www.eere.energy.gov/buildings/appliance\\_standards/commercial/distribution\\_transformers.html](http://www.eere.energy.gov/buildings/appliance_standards/commercial/distribution_transformers.html).) This approach involves deriving the discount rates for commercial consumers, in this case, the bottling companies or the vending machine operators, by estimating the cost of capital to the companies that purchase the beverage vending machines covered under this rulemaking. The Department typically uses the cost of capital to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so the cost of capital to the firm is the weighted-average cost of equity and debt financing. This corporate finance approach is referred to as the weighted-average cost of capital (WACC).

The Department will include for public comment in the ANOPR the discount rates and calculations associated with the LCC of beverage vending machines.

*Item 8-2 The Department seeks comment on the proposed approaches for estimating discount rates for consumers using the equipment covered under this rulemaking.*

*Item 8-3 The Department recognizes that a large fraction of the consumers of beverage vending machines are beverage bottlers. Which commercial sectors besides the bottlers should be considered in the evaluation of discount rates? In addition, do stakeholders believe that government direct purchases of this equipment are large enough to require that they be included in the evaluation of discount rates?*

### 8.4 Maintenance, Repair, and Installation Costs

The Department understands that rebuilt beverage vending machines may be a large part of the market. The ENERGY STAR program defines a "Rebuilt refrigerated beverage vending machine" as a UL Listed or Classified model that has been previously in use and subjected to various degrees of retrofitting, remanufacturing, refurbishing, repairing, or reconditioning for resale or reuse.<sup>7</sup> This could range from fixing up nicks and scratches to re-painting, re-lamping, or changing signage, all the way to replacing the compressor or other critical components. Consequently, rebuilding of a machine may range from no change to a significant improvement of the energy performance of the machine. Some machines may undergo three or four cycles of rebuilding. The Department acknowledges that separate mechanisms are in place for rebuilding beverage vending machines; however, it will consider only expected routine installation,

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<sup>7</sup> See the "Definitions" section of the "Eligibility Criteria" of the "ENERGY STAR<sup>®</sup> for Refrigerated Vending Machines Rebuilt Machine Specification March 2, 2006, DRAFT 2" at [http://www.energystar.gov/index.cfm?c=revisions.rebuilt\\_vending\\_spec&layout=print](http://www.energystar.gov/index.cfm?c=revisions.rebuilt_vending_spec&layout=print).

maintenance, and repair costs over the life cycle of originally manufactured machines that are covered under this rulemaking.

The Department understands that small incremental changes in equipment efficiency typically incur no, or only very small, changes in repair and maintenance costs over baseline products. There is a greater probability that equipment with efficiencies that are significantly greater than the baseline will incur increased repair and maintenance costs since such equipment is more likely to incorporate technologies that are not widely available. The Department will rely on input from manufacturers and other stakeholders in developing appropriate incremental repair and maintenance costs for higher efficiency equipment if stakeholders feel such estimates are necessary.

Unless the efficiency increases considered for this rulemaking result in significantly larger or heavier products, the Department expects that more-efficient beverage vending machines will not incur increased installation costs.

- Item 8-4 The Department seeks feedback on what fraction of the installation, maintenance, and repairs involve efficiency improvements and what are the typical practices during the life cycle of an originally manufactured beverage vending machine (e.g., change lamps but not the compressor)?*
- Item 8-5 What is a typical time period between the sale of a new product and the first maintenance or repairs? What are the typical cycles of maintenance and repairs?*
- Item 8-6 The Department seeks feedback on whether and how routine maintenance, repair, and installation costs will change for more efficient products.*
- Item 8-7 If it is not appropriate to assume that changes in maintenance, repair, or installation costs would be negligible for more efficient products, the Department seeks feedback on appropriate methodologies for assessing changes to each of these costs.*

## **8.5 Equipment Lifetimes**

The Department will use information from various literature sources (e.g., *Vending Times*) and input from manufacturers and other stakeholders to establish average equipment lifetimes for use in the life-cycle cost and subsequent analyses.

A typical vending machine undergoes periodic refurbishments during its lifetime. Depending on the frequency of the refurbishments and their nature with regard to improvements in energy performance, these refurbishments may change the useful lifetime of the equipment.

Based on consideration of the comments received on the ANOPR, the Department will make necessary changes to the analyses. These changes will be reflected in the documentation of the NOPR.

*Item 8-8 The Department seeks feedback on appropriate equipment lifetimes for the beverage vending machines covered under this rulemaking.*

*Item 8-9 Is there a suitable inventory model that could be used to estimate the fraction of new versus rebuilt/refurbished machines in the market? If no inventory model exists, what is the impact of refurbishment on the equipment lifetime? The Department also seeks feedback on the number of refurbishment cycles in the typical lifetime of the beverage vending machines.*

## **9 SHIPMENTS ANALYSIS**

Shipment forecasts are required to calculate the national impacts of standards on energy consumption, net present value (NPV), and future manufacturer cash flows. The Department plans to develop shipment forecasts based on an analysis of key market drivers for beverage vending machines.

### **9.1 Base Case Forecast**

To evaluate the various impacts of standards, the Department must develop a base case forecast against which to compare forecasts for higher efficiency levels. The base case forecast is designed to depict what will happen to energy consumption and energy costs over time if the Department does not adopt new energy conservation standards for the equipment covered under this rulemaking. In determining the base case forecast, the Department will consider historical shipments, the mix of efficiencies sold in the absence of standards, and how that mix might change over time. For these purposes, the Department needs data on historical product shipments and the market shares of the different efficiency levels offered in each product class.

*Vending Times* reports historical shipments for beverage vending machines as an overall product group. (See <http://www.vendingtimes.com/ME2/default.asp>.) In addition, the Bureau has also published limited statistics on the quantity and value of product shipments. (See <http://www.census.gov/>.) Bureau data is available online for the years 1995, 1996, 1999, and 2000 for refrigerated soft drink vending machines. This data is not broken down by product class. The data collection was discontinued after the publishing of the 2000 data, so no additional data from the Bureau beyond 2000 will be available.

The Department hopes to collect shipment data within each product class, as well as market-share efficiency data (i.e., data on the distribution of product shipments by efficiency) for each product class. The Department recognizes that this information may be difficult to collect, and may therefore consider using other methods for estimating the efficiency distribution in the market. For example, when market-share efficiency data are not available, the Department may use efficiency distributions based on available models as a proxy. The Department may also

request separate shipment information for products sold with specific design features (e.g., ECM evaporator fan motors).

## **9.2 Accounting Methodology**

The Department proposes to determine annual shipments in the base case by accounting for new building construction and historical rates of product ownership (saturation rates) in buildings. For product retirements, DOE will use the same product lifetimes and retirement functions that it generates for the life-cycle cost and payback period analysis. This method has the distinct advantage of separately accounting for units installed in new construction and existing buildings. More importantly, the Department can express product saturation rates as a function of consumer price and operating cost to capture their impact on future shipments. The Department plans to rely on EIA's *AEO* to forecast new commercial construction.

The Department will also consider any other input provided by stakeholders.

*Item 9-1 The Department seeks information on representative saturation rates for each product class covered under this rulemaking, as well as industry-trend data regarding relative growth in each product class.*

*Item 9-2 The Department seeks input on whether there are better methods of forecasting the markets for each product class and access to models or methods that could be used to forecast shipments.*

## **9.3 Standards Impacts on Product Shipments**

For each product, the Department will develop a set of shipment forecasts for the covered equipment for each set of standards analyzed. These standards-case forecasts will be used to evaluate the impacts of standards on product shipments. Standards-case forecasts are derived using the same data-sets as base-case forecasts; however, because the standards-case forecasts take into account the increase in purchase price and the decrease in operating costs caused by standards, forecasted shipments typically deviate from the base case. The magnitude of the difference between the standards-case and base-case shipment forecasts depends on the estimated purchase-price-increase as well as the operating-cost-savings caused by the standard. Because the purchase price tends to have a larger impact than operating cost on equipment purchase decisions, standards-case forecasts typically show a drop in product shipments relative to the base case.

The Department's past standards analyses have attempted to quantify the sensitivity of shipments to purchase price and operating-cost-savings. Because the data required to develop these sensitivities are limited and often difficult to obtain, the Department will consider modeling standards-case shipments forecasts with scenarios (i.e., specified impacts to product shipments) rather than developing sensitivities to purchase price or operating-cost-savings.

Market-pull programs, such as consumer rebate programs that encourage the purchase of more-efficient products and manufacturer tax credits that encourage the production of more-efficient

products, also affect standards-case forecasts. When such programs exist, the Department considers their impact on the forecast of both standards-case and base-case shipments.

*Item 9-3 As part of its preliminary manufacturer impact analysis, the Department will seek input from manufacturers on the potential impact of new energy conservation standards on product shipments. Other stakeholders are also welcome to provide input. The Department also requests input on any market-pull programs that currently exist to promote the adoption of more-efficient products.*

## **10 NATIONAL IMPACT ANALYSIS**

Section 8 discusses methods for estimating the LCC savings and payback period for individual consumers. This section discusses the Department's assessment of the aggregate impacts at the national level. Measures of impact to be reported include the net present value (NPV) of total consumer LCCs and national energy savings.

### **10.1 Inputs to Forecast**

Analyzing national impacts of Federal energy conservation standards requires a comparison of projected United States energy consumption for the beverage vending machines covered under this rulemaking with, and without, new or amended energy conservation standards. The forecasts contain projections of unit energy consumption for new equipment, annual equipment shipments, and the price of purchased equipment. The derivations of the base-case shipments forecasts are discussed in section 9.1. Approaches to determining retail prices are described in section 7, while approaches to determining per-unit net-energy-consumption impact are described in section 6.

### **10.2 Calculation of Energy Savings**

The Department intends to calculate national energy consumption for each year beginning with the expected effective date of the standards. It will calculate national energy consumption by fuel type for the base case and each standard level analyzed. The Department plans to perform this calculation through the use of a spreadsheet model that effectively multiplies annual shipment forecasts by unit energy savings.

In response to earlier DOE rulemakings and comments from stakeholders who asked for a simple, transparent energy savings model, the Department has developed and used national-energy-savings (NES) spreadsheet models for its standards rulemakings since 1996. The Department expects the NES spreadsheet model to provide a credible, stand-alone forecast of national energy savings and NPV of equipment costs and energy cost savings for beverage vending machines.

The Department has prepared NES spreadsheet models for other equipment<sup>9</sup> to forecast energy savings and to demonstrate how the growth in efficiency can be accounted for over time. Although these models are specific to each equipment type, their general structure can be applied to refrigerated bottled or canned beverage vending machines.

Based on consideration of the comments DOE may receive on the ANOPR, DOE will make any necessary changes to the analysis. Those changes will be reflected in the documentation for the NOPR.

*Item 10-1 The Department seeks comment on the share of the market that is met by refurbished or rebuilt machines, and on how the Department should address refurbished or rebuilt machines in this rulemaking.*

*Item 10-2 What fraction of the predicted stock in 2012 is expected to meet Tier 1 of the ENERGY STAR specifications, and what fraction is expected to meet Tier 2 of the ENERGY STAR specifications? (See ENERGY STAR Program Requirements for Refrigerated Beverage Vending Machines Eligibility Criteria, Version 1, at [http://www.energystar.gov/index.cfm?c=vending\\_machines.pr\\_vending\\_machines](http://www.energystar.gov/index.cfm?c=vending_machines.pr_vending_machines)).*

*Item 10-3 The Department seeks comment on its plan to develop NES spreadsheet models for estimating national impacts of amended energy conservation standards.*

### 10.3 Net Present Value

The Department calculates the national NPV of the standards in conjunction with the NES. It calculates annual energy expenditures from annual energy consumption by incorporating forecasted energy prices, using the shipment and average-energy-conservation forecasts described in section 9.1. The Department calculates annual equipment expenditures by multiplying the price-per-unit by the forecasted shipments. The difference between a base-case and a standards-case scenario gives the national energy-bill savings and increased equipment expenditures in dollars. The difference each year between energy-bill savings and increased equipment expenditures is the net savings (if positive) or net cost (if negative). The Department discounts these annual values to the present time and sums them to give an NPV.

Based on consideration of the comments received for the ANOPR, the Department will make any necessary changes to the analysis and candidate standard levels (CSLs). Thereafter, the Department will give stakeholders an opportunity to review the revised analysis during the NOPR stage.

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<sup>9</sup> For example, the NES model used in the Commercial Unitary Air-Conditioners and Heat Pumps rulemaking is available for examination at:  
[http://www.eere.energy.gov/buildings/appliance\\_standards/commercial/docs/nescuac.xls](http://www.eere.energy.gov/buildings/appliance_standards/commercial/docs/nescuac.xls)



## 11 LIFE-CYCLE COST SUBGROUP ANALYSIS

This section describes how the Department analyzes consumer impacts by dividing consumers into subgroups and accounting for variations in key inputs to the life-cycle cost analysis. A consumer subgroup comprises a subset of the population that is likely, for one reason or another, to be impacted disproportionately by new or revised energy conservation standards. The purpose of a subgroup analysis is to determine the extent of this disproportionate impact. The Department will work with stakeholders early in the rulemaking process to identify any subgroups for this consideration. However, it will not analyze the consumer subgroups until the NOPR stage of the analysis.

In comparing potential impacts on the different consumer subgroups, the Department will evaluate variations in regional energy prices, variations in energy use, and variations in installation costs that might affect the NPV of a standard to consumer subgroups. To the extent possible, the Department may obtain estimates of the variability in each input variable and consider this variability in its calculation of consumer impacts. It will discuss the variability in each input variable and likely sources of information with stakeholders.

The Department intends to consider the impact of any new standards on consumer subgroups.

*Item 11-1 The Department seeks input about what consumer subgroups the Department should consider in the present rulemaking. Examples of possible subgroups the Department could consider appropriate for beverage vending machines include independent grocery stores and small convenience stores.*

## 12 MANUFACTURER IMPACT ANALYSIS

Recently, the Department announced changes to the manufacturer impact analysis format through a report issued to Congress on January 31, 2006 (as required by section 141 of EPACT 2005 (P.L. 109-58)). This report, entitled “Energy Conservation Standards Activities,” (Standards Activities) is available on the DOE website at:  
[http://www.eere.energy.gov/buildings/appliance\\_standards/2006\\_schedule\\_setting.html](http://www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html).

Previously, the Department did not report any manufacturer impact analysis results during the ANOPR phase; however, under this new format, the Department will collect, evaluate, and report preliminary information and data in the ANOPR. (See Standards Activities, section 6.4.4.) Such preliminary information includes the anticipated conversion capital expenditures by efficiency level and the corresponding, anticipated impacts on jobs. The Department will solicit this information during the ANOPR engineering analysis manufacturer interviews.

The analysis of impacts on manufacturers is intended to provide the Department with an assessment of the potential impacts of energy conservation standards on manufacturers. In addition to financial impacts, a wide range of quantitative and qualitative effects may occur following adoption of a standard that may require changes to the manufacturing practices for these products. The Department will identify these effects through interviews with manufacturers and other stakeholders.

## 12.1 Sources of Information

Many of the analyses described earlier provide important information that the Department uses as inputs for the manufacturer impact analysis. Such information includes financial parameters developed in the market assessment (section 3.1), manufacturing costs and prices from the engineering analysis (sections 5.2 and 5.3), retail price forecasts (section 7), and shipments forecasts (section 9.1). The Department supplements this information with information gathered during manufacturer interviews. The interview process will play a key role in the manufacturer impact analysis, as it provides an opportunity for interested parties to express their views on important issues.

The Department will conduct detailed interviews with manufacturers to gain insight into the range of potential impacts of standards. During the interviews, the Department will solicit information on the possible impacts of standards on manufacturing costs, equipment prices, sales, direct employment, capital assets, and industry competitiveness. Both qualitative and quantitative information are valuable. The Department will schedule interviews well in advance to provide every opportunity for key individuals to be available. In addition, an interview guide will be provided before the interviews to allow the manufacturers to gather the appropriate information. Although a written response to the questionnaire is acceptable, the Department prefers an interactive interview process because it helps clarify responses and provides the opportunity for additional issues to be identified.

The Department will ask that interview participants identify all confidential information provided, both in writing and orally. While it will consider information gathered, as appropriate, in its decision-making process, the Department will not make confidential information available in the public record. The Department will also ask participants to identify all information that they wish included in the public record, but that they do not want to have associated with their interview. The Department will incorporate this information into the public record, but will report it without attribution.

The Department will collate the completed interview questionnaires and prepare a summary of the major issues and outcomes. This summary will become part of the technical support document produced for this rulemaking.

*Item 12-1 What procedures should the Department follow when scheduling interviews and requesting information?*

## 12.2 Industry Cash Flow Analysis

The industry cash flow analysis relies primarily on the Government Regulatory Impact Model (GRIM). The Department uses the GRIM to analyze the financial impacts of more stringent energy conservation standards on the industry that produces the products covered by the standard.

The GRIM analysis uses a number of factors—annual expected revenues; manufacturer costs such as costs of goods sold; selling, general, and administrative costs; taxes; and capital expenditures related to depreciation, new standards, and maintenance—to arrive at a series of

annual cash flows beginning from the announcement of the new standard and continuing for several years after its implementation. The Department compares the results against base-case projections that involve no new standards. The financial impact of new standards is then the difference between the two sets of discounted annual cash flows. Other performance metrics, such as return on invested capital, also are available from the GRIM.

The Department will gather this information from two primary sources: the analyses conducted to this point, and interviews with manufacturers and other stakeholders. Information gathered from previous analyses will include financial parameters, manufacturing costs, price forecasts, and shipments forecasts. Interviews with manufacturers and other stakeholders will be essential in supplementing this information.

### **12.3 Manufacturer Subgroup Analysis**

It is possible that the use of average-industry-cost values will not adequately assess differential impacts among subgroup manufacturers. The Department recognizes that smaller manufacturers, niche manufacturers, and manufacturers exhibiting a cost structure that differs substantially from the industry average may be differentially impacted by the imposition of standards. Ideally, the Department would consider the impact on each individual firm. In highly concentrated industries, this may be possible. However, within common industries that have numerous participants, the Department will use the results of the market and technology assessment to group manufacturers into subgroups, as appropriate.

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| <p><i>Item 12-2 The Department seeks comment on the establishment of manufacturer subgroups for beverage vending machines.</i></p> |
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### **12.4 Competitive Impacts Assessment**

The EPCA directs the Department to consider any lessening of competition that is likely to result from the imposition of standards. (42 U.S.C. 6295(o)(2)(B)(i)(V) and 6316(e) added by section 136(h)(3) of EPACT 2005) It further directs the Attorney General to determine, in writing, the impacts, if any, of any lessening of competition. (42 U.S.C. 6295(o)(2)(B)(ii) and 6316(e) added by section 136(h)(3) of EPACT 2005) The Department will make a determined effort to gather firm-specific financial information and impacts. The Department will then report the aggregated impact of the standards on manufacturers. The competitive impacts assessment will focus on assessing the impacts to smaller, yet significant, manufacturers. The Department will provide the Attorney General with a copy of the NOPR for consideration in his evaluation of the impact of standards on the lessening of competition. The Department will base the assessment on manufacturing cost data and on information collected from interviews with manufacturers. The manufacturer interviews will focus on gathering information that would help in assessing asymmetrical cost increases to some manufacturers, increased proportion of fixed costs potentially increasing business risks, and potential barriers to market entry (e.g., proprietary technologies).

## 12.5 Cumulative Regulatory Burden

Finally, the Department is aware that other regulations may be placed on equipment covered under this rulemaking as well as on other equipment which may be manufactured by the manufacturers of equipment covered under this rulemaking. Multiple regulations may result in a cumulative regulatory burden on these manufacturers. The Department will address and seek to mitigate the overlapping effects on manufacturers of amended DOE standards and other regulatory actions affecting the same equipment or companies.

*Item 12-3 What regulations or pending regulations should the Department consider in the analysis of cumulative regulatory burden?*

## 13 UTILITY IMPACT ANALYSIS

The utility impact analysis will include an analysis of both the electric and the gas utility industries. The Department is considering adapting the National Energy Modeling System (NEMS) produced by the EIA for this analysis. The NEMS (EIA 2005) is a large, multi-sectoral, partial-equilibrium model of the United States energy sector that has been developed over the past decade by the EIA, primarily for the purpose of preparing the Department's AEO. In prior rulemakings, a variant of NEMS (currently identified as NEMS-BT, where BT refers to the DOE Building Technologies Program) was developed to better address the particular impacts of an energy efficiency standard for commercial equipment.

The NEMS produces a widely recognized baseline energy forecast for the United States through the year 2030, and is available in the public domain. The typical NEMS outputs include forecasts of electricity sales, price, and avoided capacity. The Department plans on conducting the utility-impact analysis as a scenario departing from the latest AEO reference case. In other words, the energy savings impacts from amended energy conservation standards will be modeled using NEMS-BT to generate forecasts that deviate from the AEO reference case.

While NEMS has been used to model utility impacts for energy conservation standards analyses in the recent past, the presumed relatively small impacts on the total utility sector for this product may suggest other approaches.

*Item 13-1 The Department seeks input on its proposed use of NEMS-BT to conduct the utility impact analysis.*

*Item 13-2 Should the Department consider using methods other than NEMS in the utility impact analysis?*

## 14 EMPLOYMENT IMPACT ANALYSIS

The imposition of standards can impact employment both directly and indirectly. Direct employment impacts are changes in the number of employees at the plants that produce the covered equipment, along with the affiliated distribution and service companies, resulting from

the imposition of standards. The Department will evaluate direct employment impacts in the manufacturer-impact analysis, as described in section 12. Indirect employment impacts may result from expenditures shifting between goods (the substitution effect) and changes in income and overall expenditure levels (the income effect) that occur due to the imposition of standards. The combined direct and indirect employment impacts will be investigated in the employment-impact analysis using the Pacific Northwest National Laboratory's "Impact of Sector Energy Technologies" (ImSET) model. The ImSET model was developed for the Department's Office of Planning, Budget, and Analysis, and estimates the employment and income effects of energy-saving technologies in buildings, industry, and transportation. In comparison with simple economic multiplier approaches, ImSET allows for more complete and automated analysis of the economic impacts of energy conservation investments.

*Item 14-1 The Department requests feedback on this approach to assessing employment impacts.*

## **15 ENVIRONMENTAL ASSESSMENT**

The primary environmental effects of energy conservation standards for the beverage vending machines covered under this rulemaking will be reduced emissions resulting from reduced electrical energy consumption. The environmental impact analysis will track the impact of possible standards on three types of energy-related emissions: carbon dioxide (CO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), and sulfur dioxide (SO<sub>2</sub>). The Department intends to base these calculations on the NEMS-BT modeling work proposed for the utility impact analysis. This approach has the advantage of examining the marginal impact of standards for the covered equipment on the utility generation mix and the subsequent environmental emissions.

Carbon emissions are tracked in NEMS-BT by a detailed module that produces robust results because of its broad coverage of all sectors and inclusion of interactive effects. NEMS-BT also includes a module for SO<sub>2</sub>-allowance trading and delivers a forecast of SO<sub>2</sub>-allowance prices. It is important to note that simulation of SO<sub>2</sub> trading tends to imply that physical emissions effects will be zero. However, there is an SO<sub>2</sub> benefit from conservation in the form of a lower allowance price and, if large enough to be calculable by NEMS, this value can be reported. NEMS-BT also has an algorithm for estimating NO<sub>x</sub> emissions from power generation.

*Item 15-1 The Department requests feedback on this approach to assessing the environmental factors.*

## **16 REGULATORY IMPACT ANALYSIS**

In the NOPR stage, the Department will prepare a regulatory impact analysis (RIA) pursuant to Executive Order (E.O.) 12866, "Regulatory Planning and Review," 58 FR 51735, October 4, 1993, which is subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) at the Office of Management and Budget. The RIA will address the potential for non-regulatory approaches to supplant or augment energy conservation standards to

improve the energy efficiency or reduce the energy consumption of the beverage vending machines covered under this rulemaking in the market.

The Department recognizes that voluntary or other non-regulatory efforts by manufacturers, utilities, and other interested parties can result in substantial improvements to energy efficiency or reductions in energy consumption. The Department intends to consider the likely effects of non-regulatory initiatives such as the ENERGY STAR program on equipment energy use, consumer utility, and LCC. The Department will base its assessment on the actual impacts of any such initiatives to date, but also will consider information presented regarding the impacts that any existing initiative might have in the future.

*Item 16-1 The Department is aware of the existing ENERGY STAR program for the beverage vending machine industry covered under this rulemaking. Are stakeholders aware of any other such programs that should be examined as optional, non-regulatory approaches?*

*Item 16-2 Are there specific subgroups of end-users whom the Department should consider in its review of potential adverse impacts from standards developed under this rulemaking*